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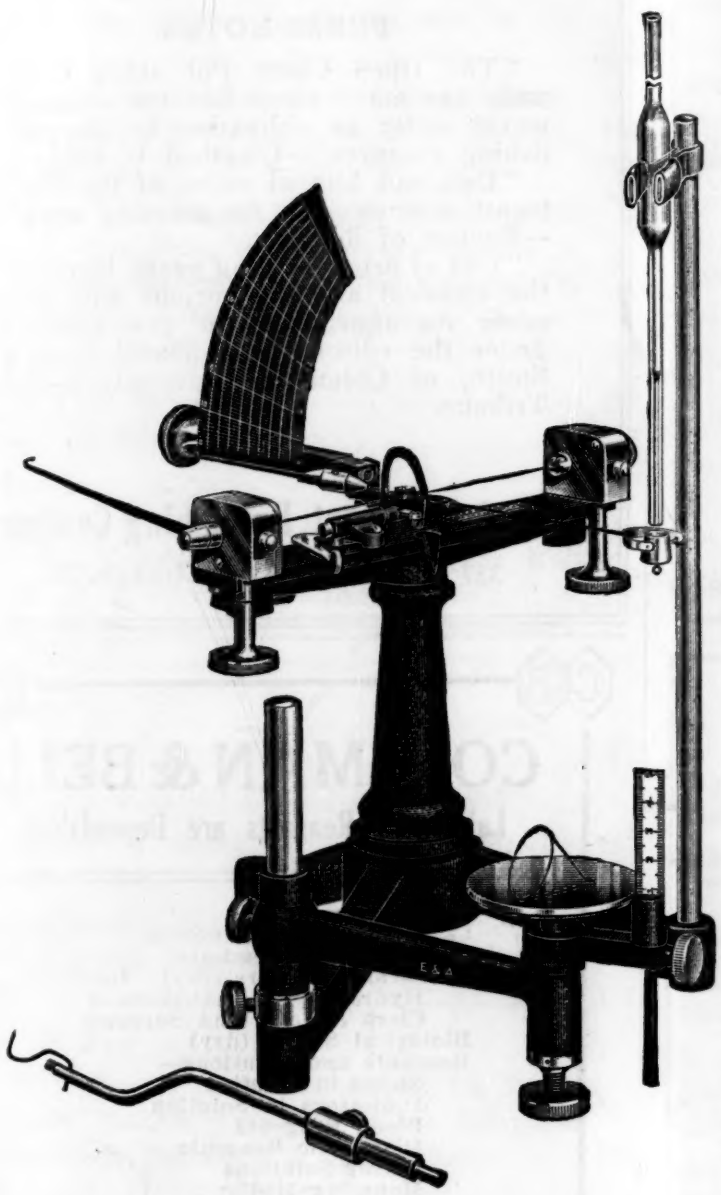

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SCIENCE

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THE AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE

RENO MEETING OF THE PACIFIC DIVISION

THE eleventh annual meeting of the Pacific Division held at Reno, Nevada, June 22 to 24, 1927, was generally conceded to be a very successful one, especially from the viewpoint of the visiting scientists. That nearly 200 could be gathered together at a point so remote from population centers was considered a notable achievement. Credit is due President Walter E. Clark and his very efficient committee on arrangements, under the chairmanship of Professor Maxwell Adams, for the harmonious functioning of the various programs.

The outstanding event of the general sessions was undoubtedly the address of President Arthur A. Noyes on "The Periodic Relations of the Elements." This occurred on Wednesday evening, June 22, when after a charmingly cordial welcome by President Clark, of the University of Nevada, and the acknowledgment on behalf of the executive committee by Vice-president Joel H. Hildebrand, President Noyes launched into his theme.

The progression and recurrence of chemical and physical properties with increasing atomic number was considered in relation to the knowledge of the structure of atoms as developed within the past two years by spectroscopists and physicists.

A novel feature of the lecture was the presentation of a large colored chart showing the energy-levels and quantum relations of the constituent electrons in the various neutral atoms and in the ions resulting from them by successive losses of electrons. By frequent references to this chart, it was shown in general that these modern conceptions of atomic structure correspond to the well-known periodicity of properties; and in particular the extent was indicated to which these conceptions account for such properties as valence, ion-formation in crystals and solutions, and the radii of neutral atoms and of the ions in the solid states.

It is hoped that this address may be published for the benefit of members who were unable to attend the meeting as well as for the information of the interested public.

The Research Conference scheduled for the luncheon period of the second day was accorded more time than at previous meetings and embraced reports of recent achievements in research in Pacific Coast labo-

ratories. Each speaker briefly presented notable results in his field, the whole forming a fairly comprehensive view of scientific activities during the past year. In this way, Dr. Walter S. Adams, of the Mount Wilson Observatory, treated the subject of astronomy; Dr. Leonard B. Loeb, of the University of California, physics; Dr. R. E. Swain, of Stanford University, chemistry; Dr. Charles B. Lipman, of the University of California, botany; Dr. C. V. Taylor, of Stanford University, zoology, and Dr. P. J. Hanzlik, of Stanford University, medicine.

This method of presenting at one meeting a general review of the whole field of science met with great favor. It was felt that these research announcements must henceforth form a regular feature of the annual meeting. Such a "clearing house" in the hands of leading specialists should prove of great value in acquainting the scientist with what is engaging the attention of his fellows and perhaps lead in some degree to coordination of effort. One delegate vouchsafed the opinion that such a session might well be adopted as a feature of the annual meeting of the parent association.

A symposium on "The Scientific Problems of an Arid Region" was presented, with Gilbert Smith, professor of botany, Stanford University, Tracy I. Storer, associate professor of zoology, University of California, and J. Claude Jones, professor of geology, University of Nevada, as participants.

The address of Professor Henry H. Dixon, of the University of Dublin, was of absorbing interest. An abstract of Professor Dixon's paper on "The Nerves of Plants" follows:

From early times the cords of stringy tissue distributed through the parts of plants, especially through the leaves, have been called nerves. The general resemblance of the distribution of these cords to that of nerves in man and animals is sufficient apology for the name.

Later, when it was found their minute structure was wholly different and that they discharged functions wholly unlike those performed by the nerves, their appellation was changed. They were called veins—because they transmit fluids through the plant body; and, it may be noted, their peculiar structure allows these fluids to be dragged through them in a state of tension.

At the same time observation and experiment clearly showed that plants are sensitive to external stimuli and that often these stimuli are transmitted considerable distances in a plant from the point of reception to the place where the response is manifested. An outstanding example is furnished by the sensitive plant. A touch on the leaf-tip of this plant will cause not only the leaflets of the tip touched to fold up, but even the leaf-stalk to bend downward and also, after a short time, similar changes in the other leaves of the plant. Here the stimulus is transmitted in the plant for many inches.

The mystery of this was at first explained by adding it to the long debt already accumulated by the vital properties of the protoplasm—an admission of ignorance under the cloak of dogma. MacDougal in America and other investigators discredited this bill by showing that the stimulus is transmitted across dead tissues.

Ricca in Italy confirmed these observations and showed that the stimulus liberated a soluble substance into the stretched fluid in the capillaries of the veins. This is instantly dragged through the veins to the responding tissues.

It has also been shown that the stimuli of light, gravity and touch liberate *diffusible* substances in the tissues of other plants, and it seems certain that these substances are hurried in the same way through the wood *capillaries* to the point of response.

Thus the swing of the pendulum of scientific opinion has brought us to regard the vascular bundles of plants, if not as nerves, at least as channels for conveying messages from the point of reception to that of response.

Such material messages conveyed in the moving fluids of the animal body are well known. They are called "hormones."

With a total registration of 182 the attendance is hardly comparable with other meetings of the Pacific Division. However, it is to be noted that the registration was composed almost exclusively of scientists geographically distributed as follows:

Arizona	5
British Columbia	1
California, northern	81
California, southern	30
Colorado	2
Honolulu	1
Idaho	3
Ireland	1
Massachusetts	1
Minnesota	1
Mississippi	1
Nevada	25
New Mexico	1
Oregon	14
Philippine Islands	1
Quebec	1
Texas	1
Utah	6
Washington	3
Washington, D. C.	2
Wisconsin	1
	182

Reports received from the secretaries of societies holding sessions at the Reno meeting are presented as follows:

AMERICAN ASSOCIATION OF ECONOMIC ENTOMOLOGISTS, PACIFIC SLOPE BRANCH

(Roy E. Campbell, secretary, Alhambra, Calif.)

Although the attendance and number of papers were somewhat fewer than for several previous years, an excellent program was presented. Mr. F. B. Herbert told of a method of spraying for thrips which was almost as fast as dusting. Professor H. J. Quayle's paper on "Spraying and Fumigating Combination for Control of Resistant Red Scale" brought out the fact that neither spraying nor fumigation alone is entirely satisfactory in controlling the resistant red scale of southern California districts, but that a combination is successful. Moreover, fumigation following spraying is best, because the light oil-spray used loosens up the scales and forms a protective film on the foliage, so that the fumigation following kills the remaining live scales and does not injure the foliage. Professor Ralph H. Smith's paper on "Investigations and Arsenical Residue on Apples" showed that lead arsenate alone sprayed on small apples is soon sloughed off, but when used with a spreader remains on the constantly enlarging apple for a long time. Also there is a decided increase in the amount of arsenic on the apples after each spraying, which gradually decreases up to the time of the next application.

In the symposium held jointly with the Pacific Coast Entomological Society on the topic "Arousing Public Interest in Entomology," Roy E. Campbell mentioned some of the reasons for a greater public interest. Professor R. W. Doane's paper showed the importance of a more general knowledge of insects and disease in order to keep from becoming infected and also prevent insects from spreading disease. Mr. W. C. Jacobsen told how a more general knowledge of insects and an appreciation of their importance would help the quarantine officers in their efforts to prevent the introduction of injurious pests. Probably the most interesting paper on this topic was Mr. B. Cain's, on his work among Boy Scouts. The boys show a tremendous interest in nature, and the insects, with their variety of forms and colors, diversity in habits and their marvelous interrelationships, present a wonderful field for out-of-door study.

Dr. S. B. Freeborn's paper on "Efficient and Practical Control of House Flies" brought out the fact that several "fly sprays" were effective in keeping flies off of dairy cattle, but that their use actually reduced the production of milk, because of an accompanying rise in temperature and respiration in cows to which the material had been sprayed. Professor Doane in his paper on "Difficulties of Mosquito Control" showed that although mosquito abatement districts might clean up all the breeding places they were still subject to an occasional infestation due to mosquitoes being carried in by the wind from outside the district. Cooperation of all affected districts was the remedy suggested. Mr. S. J. Snow's paper on "Effect of Ovulation on Seasonal History of the Alfalfa Weevil" showed that beetles remained immature until fall or longer of their first season, and that eggs and larvæ found in the summer are retarded members of the old overwintering generation and not a partial new brood.

In Mr. Walter Carter's paper on "Isolation of Certain Yeasts and Allied Forms from *Eutettix tenellus*" the most interesting point was the mention of a new method of feeding sucking insects by the utilization of an animal membrane filled with the plant juices. This offers an artificial method of feeding sucking insects which has many advantages over the old method of using live plants, twigs or leaves.

Officers elected for the ensuing year are: *Chairman,* R. S. Woglum; *Vice-chairman,* Geo. M. List; *Secretary-Treasurer,* Roy E. Campbell.

THE AMERICAN CHEMICAL SOCIETY

(Geo. W. Sears, secretary pro tem.)

Western sections of the American Chemical Society united in a regional meeting as a section of the Pacific Division. Two sessions were held during which nineteen papers were presented by members from Washington, Oregon, California and Nevada.

"Essential Oils from Some Desert Plants" was discussed by Maxwell Adams. An unusually large proportion of desert plants contain volatile oils and many of the plants now cultivated for essential oils are natives of arid regions. Twelve varieties of plants were examined and the essential oils extracted by steam distillation and the physical constants of three were discussed at length.

"The Oxidation of Sulfides in Alkaline Solution," presented by Ludwig Rosenstein, brought the fact that sulfides in solutions whose sulfide-ion concentration is determined by the presence of carbonates and bicarbonates are rapidly oxidized by air in the presence of small amounts of nickel or cobalt sulfide catalyst. Sulfur is the principal reaction product, though thiosulfate and tetrathionate are also formed. The process has been applied to gas purification and has resulted in the production of an amorphous wettable sulfur useful for agricultural sprays.

"The Electrolytic Reduction of Sodium Nitrate," by H. K. Benson and J. L. Hoard, was presented by Dr. Benson. When sodium nitrate is electrolyzed fumes of NO_2 and NH_3 are evolved. Investigation of the nature and conditions affecting the reaction

brought out the fact that mercury was the most suitable cathode. The proportion of ammonia produced depends largely on the condition of the electrodes. With bright electrodes the reduction to ammonia was found to be very small, while tarnished electrodes gave nearly complete reduction to ammonia. Large scale operation showed 80 per cent. reduction to ammonia with 70 per cent. current efficiency. In discussing "The Carbonization of Sawmill Waste," by H. K. Benson and W. L. Beuschlein, Dr. Benson showed that sawdust could be converted almost quantitatively to charcoal in a rotary kiln, making use of a counter current air supply just sufficient to burn a fine-grained charcoal not spontaneously combustible.

"The Commercial Production of Port Orford Cedar Wood Oil," by Floyd E. Rowland, and the "Analysis of Port Orford Cedar Wood Oil," by P. H. Thurber, were presented by Mr. Thurber. Analysis showed 46 per cent. alpha pinene, 3 per cent. limonene, 26 per cent. borneol, 21 per cent. cadinene and 4 per cent. cadinol. The alpha pinene gave an optical rotation of +53, which is much higher than the alpha pinene found in turpentine. Since there should be four alpha pinenes it was thought this was a different one from that found in turpentine. Since the oil proved to be different from the eastern product its commercial production will probably depend on extraction and utilization of the different components.

In discussing "The Mechanism of Light Rotation by the Asymmetric Carbon Atom," H. G. Tanner pictured a mechanical atom in which the asymmetry was caused by the forces holding the different groups rather than by the groups themselves. This conclusion was drawn from experiments with a mechanical model arranged to demonstrate the effect of polarized light.

"The Determination of Tantalum and Columbium," by Geo. W. Sears, presented the results of an attempt to apply the principles found in a previous investigation to be effective for separating the two elements to their quantitative determination. When an ore of tantalum and columbium is fused with sodium pyrosulfate at a temperature of 835–875° C. the tantalum is rendered insoluble in concentrated sulfuric acid, while the columbium remains soluble. If the fusion is made at a low temperature (about 600° C.) interfering elements can be removed by solution in hot 3N hydrochloric acid without dissolving any of the tantalum or columbium and the combined tantalum and columbium may be determined by igniting and weighing the residue obtained. By fusing this residue with sodium pyrosulfate and raising and holding the temperature at 835–850° C. for 12–15 minutes the tantalum is rendered insoluble in concentrated sulfuric acid.

"The Reactivity of the Fused Alkali Amides," by F. W. Bergstrom and W. C. Fernelius, illustrated the similarity between reactions in liquid ammonia and water solutions. Both the strongly electropositive and strongly electronegative elements react readily with fused potassium or sodium amide, while the elements of intermediate electroaffinity, such as nickel, copper and iron, exhibit little or no action.

In his discussion of "Low Students in Chemistry," R. A. Osborn showed that three fourths of the conditioned students, if given a review course, pass, although they remain poor students in the next course. It was a question, therefore, whether they should not have been required to repeat the course in class.

"Emulsification of Solid Powders," by J. H. Hildebrand, A. J. Scarlett and W. L. Morgan, extended to solid powders, such as lampblack and manganese dioxide, the work of Hildebrand, Draper and Finkle, who had shown, in the case of benzene-water emulsions, that the type of emulsion and its stability may be controlled by using different metallic salts of the fatty acids.

In discussing "Quantitative Treatment of Deviations from Raoult's Law," J. H. Hildebrand stated that in the opinion of many authorities, Raoult's law provides a better starting point for the development of systematic thermodynamic treatment of solutions than does Van't Hoff's classic law of osmotic pressure. In its simple form it applies to very few systems and the departures in many cases are too great to be brought into order by the modifications of Raoult's equation. It has been found possible to introduce an exponential factor, involving the gas content, absolute temperature and a specific constant for each system, into the ordinary equation of Raoult which not only applies to all the regular systems (those which obey Raoult's simple law over some small range of concentration) but enables the solubility of one substance in another to be calculated at all temperatures if it is known for one temperature.

"A Laboratory Study of Nitrogen Fixation by the High Tension Arc," by H. V. Tarter and P. G. Cohen; "The Occurrence of Hydrogen Sulfide in the Lake Washington Ship Canal," by E. V. Smith and T. G. Thompson; "The Acidity of Waters of Some Puget Sound Bogs," by T. G. Thompson, J. R. Lorah and G. B. Rigg; "Improved Apparatus for the Removal of Dissolved Gases from Water," by J. R. Lorah and T. G. Thompson, and "Dissolved Gases in the Waters of Some Puget Sound Bogs," by G. B. Rigg, T. G. Thompson, J. R. Lorah and K. T. Williams, were briefly reviewed by Dr. Benson, who pointed out in connection with the first that the mass law holds approximately in the fixation of atmospheric nitrogen by means of the high tension arc and

that immediate cooling after passage through the arc is unnecessary.

Three papers were presented by E. C. Gilbert as follows: "The Freezing Point-composition Curves for the System Acetanilide-Propionanilide"—in the neighborhood of the eutectic an unstable compound is indicated by the flatness of the curve in that region; "Some Observations on an Arsenic Trisulfide Alcohol" showed that the coagulating power of ions of different valence obeyed the same general rule as in water, though the concentration necessary for precipitation was less than in water; "The Surface Tension of some Long Chain Fatty Acids in a Heavy Hydrocarbon Oil"—the surface tension as determined indicated that neither the hydrocarbon chain nor the acid radical of the fatty acid extended uniformly into the oil at the interface, but that many of the acid molecules must extend lengthwise along the surface of the oil.

At a dinner following the sessions, preliminary steps were taken toward the organization of the western sections of the American Chemical Society for the purpose of facilitating the arrangement of programs for regional meetings held in conjunction with the annual meetings of the Pacific Division of the American Association for the Advancement of Science.

AMERICAN PHYSICAL SOCIETY

(D. L. Webster, Stanford University, California, local secretary for the Pacific Coast)

The American Physical Society held two sessions, one a joint session with the Astronomical Society of the Pacific. As in most of the current meetings interest centered chiefly on spectroscopy and its application to problems of the structures of molecules and atoms, on the one hand, and stars, on the other. The aspects of molecular and atomic problems discussed at this meeting covered the whole range of such problems. There were, for example, the paper of Gibson and Ramsperger on the slow vibrations of atoms in the ICl molecule, that of King on the lines due to the valence electrons of the cerium atom, and those of Allison and Webster on the behavior of the innermost electrons in the atoms as deduced from intensity measurements by X-rays. In stellar applications of spectroscopy, interest centered on evidence from the sun, especially St. John's very careful and important revision of the solar spectrum tables.

In fields other than spectroscopic there were papers on a great variety of subjects, among which may be mentioned especially the work of Loeb and Du Sault, establishing the monomolecular character of the ions in acetylene, and the evidence presented by Brins-made for the remarkable extent to which electrons may be reflected from metals without loss of speed.

ASTRONOMICAL SOCIETY OF THE PACIFIC

(Robert G. Aitken, secretary pro tem., Lick Observatory)

The Astronomical Society of the Pacific joined with the Pacific Division and held a very successful meeting. Members of the society from Stanford University, the University of Nevada, the Lick, Howell, Mount Wilson and Students' Observatories and from San Francisco were present, and the attendance of the two sessions for the presentation of scientific papers, held on Thursday, June 23, averaged 25. The 26 papers presented, as is evident from the program, covered a wide range, the sun and the major and minor planets and comets and satellites of the solar system coming in for discussion, as well as variable and binary stars, very cool stars (cool only by comparison with average stellar temperatures), and giant M stars. Practical astronomy was represented by papers on longitude determinations, on a horizon finding card and on a working model of an instrument for determining geographical points on the Sumner line at sea. Of special interest were E. C. Slipher's papers on the Lowell Observatory observations of Mars, Merrill's paper on a search for very cool stars, the paper by Adams and Joy on the relationship of spectral type to period among variable stars, Leuschner's report on the research surveys of minor planets, and Miss Losh's paper on magnetic storms and solar activity.

The Lowell Observatory has a long and honorable record in the study of conditions upon the planets of the solar system and Slipher's paper on Mars and also the one on Jupiter and Saturn showed that this study is being pursued with ever greater success by the application of modern methods of investigation. Of particular interest was the evidence presented of seasonal changes in color on the surface of Mars—most easily explained as due to the growth and decay of vegetation; of the existence in the atmosphere of Mars of impermanent features (clouds?) of two distinct varieties, one showing strongly in photographs taken in violet light, but feebly in those taken by red light, the other having just the opposite characteristics—facts which had been clearly brought out also by Wright's observations at the Lick Observatory in 1924 and 1926; and the evidence in favor of an atmosphere of greater extent than had been generally accepted prior to Wright's work in 1924.

Merrill finds that "the sequence of giant stars seems to terminate abruptly with a group of long-period variables of classes M6e to M8e, whose effec-

tive temperatures are slightly above 2,000° C. at maximum." Stars cooler than this are not known, though present observational methods are apparently competent to reveal them if they exist. "The fact that the coolest stars we know are all long-period variables may indicate a region of instability as the temperature approaches a limit set by some physical law."

In investigating the relationship of spectral type to period among variable stars, on the basis of a study of some 60 variables with the 100-inch telescope, Adams and Joy find, first, that "a large majority of the Cepheids, including all of the brightest and best known stars, show a very nearly linear relationship between spectral type and logarithm of the period." This relationship had been known before, in a general way, though no exact correlation had been established. The "rather surprising result" of extending the investigation to the short-period cluster-type stars and the long-period red variables is that, "on the average, these two classes fall close to the curve derived from the Cepheids.—The conclusion seems to be justified that the physical cause of the variation in light of these different classes of variable stars is similar and probably is to be ascribed to a periodic variation in size."

The paper by Leuschner and Thiele giving a progress report on the research surveys of minor planets was presented by the senior author and showed in striking manner how incomplete our knowledge of the minor planets still is. Ordinarily, it is stated that between 1,100 and 1,200 of these bodies are known. If every discovery is of a different object, the actual number of those that have been observed is more nearly 2,600, but the majority were so poorly or incompletely observed that they have been "lost"; even of those regarded as known only a small fraction have orbits sufficiently well determined to warrant the publication of observing ephemerides; and the number for which thorough orbital investigations are available is small indeed. Cooperative research, under the auspices of the appropriate committee of the International Astronomical Union, is now in progress, and in this Professor Leuschner and his colleagues at the Students' Observatory are taking a leading part.

A magnetometer for recording the range in the horizontal component of the earth's magnetic field was installed at the Mount Wilson Observatory in August, 1926. Miss Losh has compared the records of magnetic storms with the observation of sunspot groups and other evidences of great solar activity and finds the usual close correlation. For example, one of the largest complex sunspot groups of the year came round the east limb of the sun on September 12, 1926; a marked magnetic storm began on September 14 and continued until this group passed around the west limb. When the disturbed area on the sun reappeared, as the result of the solar rotation, a second and even greater magnetic storm occurred on the earth on October 13.

Space limits forbid further comment on these and the many other interesting papers presented. All the research observatories in the Pacific area, from Victoria to Flagstaff, have obviously had a successful year.

Members of the society participated in the general sessions of the division on Wednesday and Thursday, Dr. W. S. Adams, director of the Mount Wilson Observatory being one of the speakers at the "Research Announcements" luncheon on Thursday.

W. W. SARGEANT,
Secretary

(To be continued)

THE EMERGENCE OF THE BIOLOGY OF FOREST AND RANGE

THE rapid rise of interest in the biology of forest and range is an outstanding sign of the scientific times. While it is true that during the past two or three decades a few writers have called pointed attention to certain phases of the problems involved, most silviculturists, biologists and range research men have overlooked them. Of necessity, since the many partial problems merge into one big bio-ecological unit, the union of biology and forestry must be something more than a companionate marriage. It must be an old-fashioned and enduring alliance. The case is the same with biology and range research.

PRESENT TRENDS

The emergence of the biology of forest and range is associated with a new interest in all phases of the environmental relations of organisms. It is increasingly realized by biologists that these environmental relations are worthy of as close, consistent, prolonged, and quantitative attention as the phases of genetics and heredity which have been examined of late years with such illuminating and valuable results.

The following events may be cited as among those which seem to show a movement of interest and attention in the right direction:

The organization and activity of the Ecological Society of America, and the noteworthy success (at least along technical lines) of its official organ, *Ecology*.

Increased recognition by the United States Department of Agriculture, especially through the Bureaus of Biological Survey, Entomology, Plant Industry and the Forest Service, of the significance and im-

portance of forest and range biology. The work and writings of certain leaders among the scientists in and out of the department, including, among others, F. E. Clements, F. C. Craighead, E. P. Farrow, J. Hoffmann, E. A. Goldman, J. Grinnell, C. F. Korstian, Aldo Leopold, W. L. McAtee, E. N. Munns, Edward W. Nelson, G. A. Pearson, V. E. Shelford, J. W. Toumey, I. Traghardh.

The publication of Jennings' "Prometheus."

The contributions of the Roosevelt Wild Life Forest Experiment Station, Syracuse University, New York, under the direction of its former head, Chas. C. Adams, and his associates.

The activities of the President's Conference on Outdoor Recreation.

The outstanding work of the special committee on forest research of the Washington Section of the Society of American Foresters, which resulted in the publication of "A National Program of Forest Research" (American Tree Association, November, 1926; by E. H. Clapp). This is unquestionably the most valuable survey of the field of forest research that has been made in this country to date. The biological side of forestry is clearly outlined, although the biological features of range research do not seem to have been so clearly appreciated.

The introduction, March 3, 1927, in the Sixty-ninth Congress, of the McSweeney Bill, providing for a more adequate forest and range research program in the United States Department of Agriculture.

The appointment of Paul G. Redington, formerly of the Forest Service, United States Department of Agriculture, as chief of the Bureau of Biological Survey.

The success of and obvious interest in the symposium on "The Forest and Forage Crops in the Southwest," held at the meeting of the Southwestern Division, American Association for the Advancement of Science, Santa Fé, New Mexico, April 13, 1927. Different aspects of the biology of forest and forage production were stressed by several of the speakers.

Forest Pathology

The important effects of parasitic plants and of wood-rotting fungi in relation to the maintenance and administration of the forest have been obvious for a considerable period to the experts of the Bureau of Plant Industry, the New York Botanical Garden, the Forest Service and a few other agencies. Indeed, forest pathology may be regarded as a relatively early emergent in the province of the biology of the forest. One has only to recall the importance of such studies as those on the chestnut blight and white pine blister rust to recognize and appreciate the far-reaching, continuing and increasing significance of forest pathology. The names of Robert Hartig, of Germany, father of plant pathology, and his disciple, F. W. Neger, and of the following American workers come to mind among those who have made notable contributions: E. P. Meinecke, W. H. Long, J. R. Wier, R. C. Colley, F. D. Heald. While *forest* pathology has developed to a considerable extent, *forage* pathology, undoubtedly an important field, has apparently received little attention.

On the whole there has been a much clearer appreciation of the plant side of forest biology—as in the development of forest pathology—than of the animal side. It is to the animal side of the biology of forest and range, therefore, that the chief attention is here addressed.

The Protection of Forest and Forage from Animal Pests

Far-sighted administrative officials, especially those on the ground, as well as progressive private users of range and of forest, have long been impressed with the damage done by animal pests. The destructive effects of bark-beetles and other insects, and of certain rodents, as the porcupine, in the woods, and of such animals as the prairie-dog and jack-rabbit on the open range, have been obvious to many. While this phase of animal relations to forest and range, referred to as "Protection," does not, even yet, receive sufficient consideration in many places, it does come nearer than any other to getting adequate attention. Indeed, it is often the only aspect of the zoology of forest and range receiving any notice at all.

Possible Beneficial Activities of Animals on Forest and Range Lands

The beneficent rôle of insectivorous birds in farming districts has been emphasized by the thorough studies of the subject made by the Biological Survey. This function of birds is widely recognized. That birds exercise a similarly beneficial service to forest trees, browse, and even forage grasses is sometimes not kept in mind. Other possible benefits by animals include the cultivation of the soil of range and forest by earthworms and burrowing rodents, the caching and planting by birds and mammals of the seeds of trees and other plants with consequent assistance to the maintenance and even extension of the vegetation, the nitrifying of the soil through the wastes and remains of the animal body, the activity of predatory insects, amphibians, reptiles, birds and mammals in destroying various other species of insects, rodents, or other forms of animals that prey on

vegetation, the serving as food for game fishes or other valuable species.

Some Bio-ecological Relations

Even moderate use by man of the timber and forage is almost sure to upset the balance between the plants and animals and their environment on forest and range lands. Clear cutting, over-grazing and burning bring about profound and often catastrophic changes, involving not only the physical but also the biotic factors of site. The removal of the plant-cover promotes destructive erosion, injures the watershed value of an area, affects for the worse the welfare of near-by farming sections and cities and often promotes disastrous floods. As Jones has pointed out, "It was destructive erosion and not war that destroyed Assyria and Babylonia" ("Watershed Handbook," U. S. Forest Service, Southwestern District, December, 1923, mimeographed). Successful natural reproduction of forest, reforestation by either seeding or planting, maintenance of desirable forage cover, all depend on adequate attention to bio-ecological problems, as does also the effective protection of game mammals, birds and fishes.

Some General Values of Wild Life

Edward W. Nelson, T. S. Palmer, Chas. C. Adams and others have pointed out the educational, recreational and financial value of wild life. Adams's recent detailed study and demonstration ("Importance of Animals in Forestry," *Roosevelt Wild Life Bulletin*, Vol. 3, no. 4, October, 1926) of the important place occupied by animals in the economics of the community is convincing and impressive. It is believed that few technical men, not to mention state and even federal administrators, fully appreciate the value of wild life. Adams very properly stresses the unity of the forest resources. To realize fully on these resources they must be intelligently managed, with the object of making each area produce the largest contribution to the people's welfare, having regard to its varied products in forage, forest and wild life.

Conclusions

Whereas, in most lines of agriculture over-production is so outstanding a phenomenon that curtailment is widely recommended by economists, precisely the opposite is the case in silviculture and forage production. America's wild crop of timber and of feed for livestock falls far short of the demand. Careful attention must be given to all the conditions surrounding the growth of these crops. Among the factors of major importance are the native animals of forest and range lands. Some are pests; others are beneficial. Most play mixed rôles. Efficient production of trees and forage necessitates thoroughgoing study of the life histories and ecology of all the predominants, both plants and animals. Many animals, especially fishes, birds and mammals, are themselves of extraordinary value for recreation, study, and as a source of income. In some instances the value of the animals on a given area may exceed that of forage or trees. The production of wild life should be more than an incident or by-product of forest and range management. The objective should be maximum continuing values from each area. Attainment of this objective necessitates additional information and increasingly enlightened administration. Research is the foundation of our present prosperity. It must be the corner-stone of future advance. "The application of traditional methods will no longer suffice." Biology must participate fully in the solution of the many problems involved.

Walter P. Taylor

Tucson, Arizona

SCIENTIFIC EVENTS

THE FIFTH INTERNATIONAL BOTANICAL CONGRESS

At the International Congress of Plant Sciences (Fourth International Botanical Congress) held at Ithaca, New York, in August, 1926, an invitation was conveyed from British botanists for the Fifth International Botanical Congress to be held in England in 1930. The invitation was accepted by the botanists assembled at Ithaca, and arrangements are now being made for the congress to be held at Cambridge about the middle of August, 1930.

An executive committee has been formed to make arrangements for the congress, consisting of Dr. F. F. Blackman, Professor V. H. Blackman, Dr. E. J. Butler, Professor Sir John Farmer, Professor F. E. Fritsch, Professor Dame Helen Gwynne-Vaughan, Dr. A. W. Hill, Professor W. Neilson Jones, Sir David Prain, Dr. A. B. Rendle (treasurer), Professor A. C. Seward (chairman), Professor W. Stiles and Professor A. G. Tansley.

It has been decided to organize the congress in the following seven sections: Morphology (including Anatomy), Paleobotany, Plant Geography and Ecology, Taxonomy and Nomenclature, Genetics and Cytology, Physiology and Mycology and Plant Pathology.

Mr. F. T. Brooks, the Botany School, University of Cambridge, England, and Dr. T. F. Chipp, Royal Botanic Gardens, Kew, England, have been appointed honorary secretaries of the congress, and any com-

munications with regard to it should be addressed to one or other of the secretaries.

THE ANTARCTIC EXPEDITION OF COMMANDER RICHARD E. BYRD

THE National Geographic Society has announced that it will cooperate in the Antarctic expedition, sending observers and contributing $25,000 toward equipment.

The society has issued the following announcement in connection with the expedition:

Conditions in striking contrast to those in the Arctic will be encountered by the Byrd expedition in the Antarctic. Instead of a vast expanse of sea and relatively low land, there is a high continent larger than Australia or the United States.

In the valleys of the Far North the summer sun brings moss, grass and flowers. But, in contrast, the bleak plateaus and mountains of the Antarctic harbor practically no living things because much of their area is perpetually blanketed by snow and ice.

Birds frequent the edge of the ice barrier where they can exist upon the creatures of the sea, but inland no life has been found because there is no vegetation.

The bears, wolves, foxes, rabbits, musk oxen and caribou of the Far North have not a single representative in the Far South known to man.

Commander Byrd's expedition will doubtless be able to augment the information contained upon the now meager maps of the Antarctic continent. Explorers can not sail along the coasts of this continent as they can along those of Australia or Africa.

The great ice barrier and pack ice keep ships at a distance, sometimes of several hundred miles. Only in a few isolated places has this barrier been penetrated. This condition is in contrast to that of Greenland, where the ice-cap extends to the coast in only a few places.

The present map of the Antarctic regions, therefore, is mostly blank, with a few patches of known territory along the coast and one or two narrow paths penetrating inland. The best known region is the land directly south of New Zealand traversed by Shackleton, Scott and Amundsen.

Among the important problems to be worked out by Commander Byrd are those relating to the meteorology of the southern continents and its effect on world weather, especially that of the southern hemisphere.

Although the field for zoological research in the Antarctic is narrow, the party will be on the lookout for any specimens that may be encountered in regions hitherto unvisited by man. Any rock specimens that give promise of adding to the geological knowledge of the unexplored continent will also be collected.

WOOD COLLECTIONS OF THE FIELD MUSEUM

WORK has been begun to make the wood collections at Field Museum of Natural History the most comprehensive and authoritative for scientific and economic reference purposes in the middle west.

Additions to the exhibits, rearrangements of them and revision of the labels are planned, all designed not only to increase the interest of the collections to the general public, but to make them also of direct service to men in the lumber business, government forestry officials and others interested in conservation and reforestation, to students and scientists specializing in this branch of botany, and to every user of wood for building or manufacturing purposes.

Professor Samuel J. Record, of Yale University School of Forestry, who has spent seventeen years in specialized research on woods and wood products, has been engaged to supervise this work, and is now at the museum. Professor Record, who has traveled widely in this country and abroad studying the various types of woods from the time of their growth in the forests through the various stages of logging and milling to their appearance as building materials or manufactured products, is the author of numerous volumes on this subject and editor of the magazine *Tropical Woods*.

A number of leading companies in the lumber and woodworking industries have indicated to the museum that they will cooperate in the work being undertaken.

Many woods from western states, some from the eastern states, and a large number from tropical and other foreign localities not heretofore included in the museum collections are to be added. These exhibits, like those already on display, will contain specimens of the trunk and foliage of the various trees as they appear in life, photographs illustrating their growth, maps showing their distribution, typical boards and specimens of the other principal economic products manufactured from them, and monographs containing the most important data regarding their growth, their properties and their uses.

Many lumber manufacturers and other users of wood are insufficiently acquainted with the various types of woods, and their uses, particularly the foreign woods. At the present time the amount of foreign woods coming into our markets is constantly increasing, owing to depletion of our own forests, and it is highly important to know which of these foreign woods are suited for various purposes, and which are not. As Chicago is the lumber center of the Middle West, the museum collections will be able to serve the entire industry in this region in adjusting itself to the new conditions which are appearing, and which will rapidly become more apparent in the near future. It is hoped that the museum's work may also furnish a contribution to the conservation and reforestation movements in this country, by supplying information which will advance these movements.

THE UPPER MISSISSIPPI WILD LIFE AND GAME REFUGE

TEN million acres of land will be embraced in federal preserves for the protection of fish, fowl and game when the government acquires the upper Mississippi wild life and game refuge. Regulations for the new preserve were signed jointly on June 24 by Secretary of Agriculture Jardine and Secretary of Commerce Hoover.

Nor is the total of protected havens for wild fowl represented by the federal acreage, for almost every state has converted areas of its own into conservation projects, and hundreds of farmers have limited hunting expeditions on their property. Figures from the United States Biological Survey, issued on July 1, according to a report issued by the Associated Press, show from 165,000 to 200,000 acres involved in the Mississippi wild fowl project, 36,000 acres of which already is under contract to the government at $5 an acre. Most of the territory is meander land, unsuited to agricultural purposes, but a number of owners are asking as much as $26 an acre.

Congress made available $3,000,000 to purchase the refuge. Only about $300,000 of that sum has been used, and whether the next session will increase the latitude in price is a matter of pertinent importance. Much of the higher-priced land lies in Illinois. Wisconsin has supplied the bulk of the present federal possessions, Minnesota recently donated its entire Mississippi holdings and the rest of the refuge is on the Iowa side of the river.

While federal regulations will predominate in the preserve, there is to be no conflict with state fish and game laws. H. P. Sheldon, chief United States game warden, is pleased with the suggested Mid-West conservation code sponsored by the Illinois General Assembly. Other states in the upper Mississippi Valley and the Great Lakes region are expected to join Illinois in adoption of uniform statutes.

Such plans are desirable. They add to conciseness and make conservation at once more practicable and more easily enforced. Our best example, according to Mr. Sheldon, is the migratory game bird treaty with Great Britain, by which wild fowls are protected in this country and Canada on a reciprocity basis.

Officials of the Biological Survey emphasize the benefit of uniformity in game laws.

For thirty years this country has worked to replace local county laws with state and federal statutes. North Carolina is the most recent state to come into the fold and now the laws of more than forty states conform to federal regulations. There is no other satisfactory way to systematize open season for especially wild geese and ducks.

Government authorities believe game to be increasing in the East. It is maintaining a level in the Middle West, while the West itself, because of drainage projects and light rainfall, has suffered a decrease.

SIR WILLIAM THISELTON-DYER

ON July 28, Sir William Thiselton-Dyer reached the age of eighty-four years. In referring to this anniversary, *Nature* writes: "His many friends rejoice to offer affectionate tribute to one who has done so much to promote and extend the plant resources of the British Empire. Nearly two years ago (September 26, 1925) we published an appreciative article upon Sir William's work at the Royal Botanic Gardens, Kew, and its influence upon both pure and economic botany, and we are glad to know that its importance is widely recognized. He and Lady Thiselton-Dyer celebrated their golden wedding on June 23, and among the messages of congratulation were one from Mr. L. S. Amery, secretary of state for the colonies, and another from Professor von Goebel, the doyen of German professors of botany. Mr. Amery referred appreciatively to Sir William's studies in the field of botanical enterprise, by which he has 'rendered such valuable services in all corners of the Empire,' and Professor von Goebel wrote: 'It was you who first brought English and German botany into association which—serving as it does purely ideal aims—could not be destroyed by the war; and, further, we German botanists remember with gratitude the great services which you rendered with regard to Kew, with which in company with the two Hookers your name also will always be connected.' It should be as encouraging to scientific workers generally as it is gratifying to Sir William Thiselton-Dyer to know that the seed of voluntary scientific service, such as was sown by him during many years, has borne rich fruits for the benefit of the human race, and that its value is understood in many lands."

SCIENTIFIC NOTES AND NEWS

PROFESSOR FRANK B. MORRISON, assistant director of the Wisconsin State Agricultural Experiment Station, has been appointed director of the New York State Agricultural Experiment Station at Geneva, N. Y., by the trustees of Cornell University. He succeeds Dr. Roscoe W. Thatcher, who resigned recently to accept the presidency of the Massachusetts Agricultural College.

DR. DAVID WHITE, who has been serving as chairman of the Division of Geology and Geography of the National Research Council for the past three years, has returned to his former position in the U. S. Geological Survey.

DR. T. WAYLAND VAUGHAN, director of the Scripps

Institution of Oceanography at La Jolla, Calif., has been appointed chairman of the committee on submarine configuration and oceanic circulation of the National Research Council and a member of the committees on features and changes of the shore line of the Pacific Coast, on quantitative data of geological processes, on sedimentation, on submarine topography and structural history of the Caribbean Gulf region and on the award of fellowships.

THE Baly Medal of the Royal College of Physicians has been awarded to Dr. A. V. Hill, since 1926 Foulerton research professor of the Royal Society. The Moxon Medal of the college has been awarded to Sir Henry Head, the neurologist.

M. EMILE PERROT, professor of pharmacy in the University of Paris, has been elected a member of the Paris Academy of Medicine.

SIR HUMPHRY ROLLESTON has been appointed by the Royal College of Physicians and Surgeons to deliver the Harveian oration in 1928; Dr. G. F. Still, FitzPatrick lecturer for 1928; Dr. J. S. Collier, Lumleian lecturer for 1928; Dr. E. P. Poulton, as Oliver Sharpey lecturer for 1928; Dr. H. H. Dale, as Croonian lecturer for 1929, and Dr. T. Izod Bennett, as Goulstonian lecturer for 1928.

BY an order of the Committee of Privy Council, Sir Hugh K. Anderson, M.D., F.R.S., master of Gonville and Caius College, Cambridge, and Professor T. R. Elliott, M.D., F.R.S., director of the Medical Unit, University College Hospital, London, have been appointed members of the British Medical Research Council to fill the vacancies caused by the retirement of Sir Frederick Andrewes and Sir Cuthbert Wallace.

W. F. JOACHIM, of the Langley Memorial Aeronautical Laboratory, has received the Rudolph Diesel prize for 1927, consisting of $100 with a certificate for his paper, "Oil Spray Investigations of the National Advisory Committee for Aeronautics," delivered at the Oil Power Week meeting, which took place in April at Pennsylvania State College.

GEORGE ST. J. PERROT, of North Dakota, has been appointed superintendent of the Pittsburgh Experiment Station of the Bureau of Mines. He succeeds Arno C. Fieldner, who recently was promoted to the post of chief engineer of the Bureau of Experiment Stations.

AT the Massachusetts Agricultural College at Amherst, Massachusetts, Dr. Robert J. McFall, extension professor of agricultural economics, on leave of absence for work in cooperation with the U. S. Department of Commerce, recently resigned to become special agent in the Bureau of Foreign and Domestic Commerce.

HENRY C. WATERMAN, of the bureau of chemistry of the U. S. Department of Agriculture, has been appointed associate chemist and will have charge of the abstracting for *The Experiment Station Record* in the sections of agricultural and biological chemistry and soils and fertilizers.

DR. F. L. KELLY, assistant professor of public health administration and lecturer in preventive medicine at the University of California, has been appointed to the position of director of public health for the city of Oakland.

DR. R. W. BALCOM, chemist in charge of the food control laboratory of the U. S. Department of Agriculture, and A. S. Mitchell, of the Food, Drug and Insecticide Administration, have been designated as members of the Food Standards Committee as two of the three representatives of the department on that committee. Two vacant places existed on the committee by reason of the transfer of Dr. W. W. Skinner and Dr. F. C. Blanck to the research unit of the Bureau of Chemistry and Soils. W. S. Frisbie, chemist in charge, office of cooperation of the Food, Drug and Insecticide Administration, is the third department representative on the committee.

SURGEON-GENERAL HUGH S. CUMMING, Surgeon B. J. Lloyd and Surgeon J. D. Long have been designated to attend the eighth Pan-American Health Conference at Lima, Peru, on October 12. One purpose of the conference is to provide for closer cooperation in the study of the health problems of the Western Hemisphere.

FRANCIS F. LUCAS, in charge of micrographic work for the Bell Telephone Laboratories, sailed for Europe on August 20. Before the International Congress for Testing Materials at Amsterdam he will present a paper on some of the laboratories' recent pioneer work in magnification of 6,000 times and more, particularly with the aid of ultra-violet light. While abroad he will confer with scientific men in the Zeiss Optical Works, who are collaborating with him in the development of instruments. He will also visit leading European laboratories.

DR. C. E. SKINNER, assistant director of engineering of the Westinghouse Electrical Company, sailed on August 17 as a delegate to the International Electrotechnical Commission Convention, which will be held at Bellagio, on Lake Como, Italy, September 4 to 24. Dr. Skinner is chairman of the Delegation of Standard Voltages, chairman of the Delegation on Traction Motors, and is the U. S. Representative of the Committee of Seven Nations of the proposed International Standards Association.

DR. FREDERICK G. KRAUSS, professor of agronomy

and genetics in the University of Hawaii, has been given leave of absence for an extended study of tropical plants, especially the pineapple, in the Dutch East Indies and Malaya, and of Cajanus in the Himalayan region. He will then proceed to Berlin for the Fifth International Congress of Genetics in September and a year's genetics study in Germany.

DR. LAURENCE H. SNYDER, associate professor of zoology at North Carolina State College, has left for Europe to take part in a symposium on blood groups at the International Eugenics Congress in Amsterdam. Before returning to the United States, Dr. Snyder will visit the larger genetics laboratories of Europe.

PROFESSOR JOHN W. FREY, of the department of geology of the University of Wisconsin, and Loyal Durand, Milwaukee, assistant in geography, are visiting Europe to become familiar with the industrial geography of Southern Belgium, the Upper Silesia area, Leipzig, North Italy, South Wales and Scotland. They will return about September 3.

PROFESSOR WILLIAM E. HOFFMANN, head of the department of biology of Lingnan University (Canton, China), has been sent by that institution to the Philippine Islands, where he is to spend two months investigating insect problems common to South China and the Philippines.

BY authority of the Cabinet permission has been granted to the American School of Archeology in Athens to carry out excavations on the site of ancient Athens. The conditions provide for the sectional expropriation of the buildings on the site within five years. The first section to be expropriated contains twenty-five buildings. Professor Capps, the director of the school, is now in the United States to raise the necessary funds. He hopes to return to Athens in October.

PROFESSOR T. SHINOSAKI, of the University of Tokyo, who has been in Germany for three years engaged in medical research for the Japanese government, is in the United States. He plans to spend some time at the Mayo Institute, Rochester, Minnesota.

IT is proposed to collect funds for the establishment of a scholarship at Armstrong College, Newcastle-on-Tyne, in memory of Douglas A. Gilchrist, professor of agriculture, who died on April 4.

IT is planned to erect a monument at Lyons to the late Count Hilaire de Chardonnet, the "Father" of the artificial silk industry.

DR. BRUCE FINK, since 1906 professor of botany in Miami University, died suddenly on July 10, in his sixty-sixth year. Dr. Fink was an authority on lichens.

DR. THOMAS W. SALMON, medical director of the National Committee for Mental Hygiene and professor of psychiatry in Columbia University, was drowned while cruising in Long Island Sound on August 13. Dr. Salmon was fifty-one years old.

INFORMATION has reached this country that Professor Rudolf Magnus, professor of pharmacology in the University of Utrecht, who was to give the Lane lectures at the Stanford University School of Medicine, San Francisco, in April, 1928, died suddenly the latter part of July. Professor Magnus intended to give five lectures under the general heading of "Contributions to Experimental Medicine and Pharmacology."

AT the invitation of the Government of the Union, the fifteenth session of the International Geological Congress will be held in South Africa in 1929, with Pretoria as its headquarters. This invitation is the outcome of a strong desire expressed at the last congress in Madrid to hold the next meeting in South Africa.

PROVISIONAL arrangements for the seventh congress of the Far Eastern Association for Tropical Medicine, to be held in Calcutta in December, show that much attention is being paid to the subject in the United Provinces, where a strong committee has been formed to entertain and inform the delegates. After a week of scientific sessions the congress will split up for tours, and one party of about 130 strong, including interpreters, will visit Benares, Lucknow, Delhi and Agra. Another party will visit the Kala Azar area in Assam.

THE permanent committee of the International Institute of Agriculture at Rome announces that applications will be received for the following appointments to the staff of the institute: One "chef de section" (chief of section) specially qualified in tropical agriculture; five "redacteurs" to write for periodicals, specially qualified in tropical agriculture, in dairy science, in plant diseases, in rural economics and in the trade in agricultural products. The minimum beginning salaries for the above positions are: For the "chef de section," 35,800 liras per annum (approximately $2,000); for the "redacteur," 22,750 liras per annum (approximately $1,300). The traveling expenses (second class) of successful candidates will be repaid when they take up their posts. Members of the staff living at a distance of more than 1,000 kilometers from Rome have a right to the payment once in three years of their traveling expenses to their countries. The appointments will be made as a result of an examination of the qualifications of the candidates, in which account will also be taken of knowl-

edge of languages. Applications should be addressed to the Bureau du Personnel, Institut International d'Agriculture, Villa Borghese, Rome.

JOHN D. ROCKEFELLER, JR., has given $60,000 a year for five years to the Memorial Hospital for laboratory and clinical research into the causes of cancer, the education of specialists who could diagnose cancer in its early stages and for improving and enlarging the nursing and medical staffs.

ONE hundred seismological stations are being built throughout the Soviet Union by the Academy of Sciences, which is undertaking to forecast earthquakes in the hope of saving life and property. Professor Nikiforoff is in charge of the work.

Nature states that the Astronomer Royal has arranged for the supply of enlarged photographic prints of the fine picture of solar prominences and inner corona secured at Giggleswick during the total eclipse of the sun on July 29. The moon's disc on the picture is 7½ inches in diameter, and the structure of the prominences and corona is remarkably fine and clear on the print. Copies may be purchased upon application to Mr. F. Jeffries, Royal Observatory, Greenwich, London, S. E. 10.

THE University of Leyden has held a special exhibition of the portraits and scientific instruments of Dutch physicians, biologists and instrument makers of the seventeenth and eighteenth centuries, in the physical laboratory of the university on the occasion of the sixth Congress of the History of Medicine, which was held in July, in Leyden and Amsterdam. *Nature* states that Drs. C. A. Crommelin, W. P. Jorissen, C. J. Van der Klaauw and W. H. Van Seters, have collaborated in producing a catalogue of the 139 objects exhibited in illustration of the work of 's Gravesande, the Munchenbroecks, Huygens, Leeuwenhoek and Swammerdam. Two of the exhibits, two object glasses made by Constantijn Huygens, junior, and signed by him "C. Huygens, 10 May 1686, Ped. 122" and "C. Huygens, 19 Jun. 1686, Ped. 84," are of great interest, because they are accurately dated documents which, taken in conjunction with the three object glasses in the possession of the Royal Society of London, and dated June 4, June 26, and July 23, 1686, are evidence of the great industry and rapidity of working of the maker. We also note the reappearance of a quadrant made by J. M. Kleman for Boerhaave for use at his country house at Oud-Poelgeest. Although not stated in the catalogue, this quadrant, after being exhibited at Oxford in 1919, was given to the University of Leyden by the late Sir William Osler.

THE annual report of the Rockefeller Foundation for 1926 shows the total amount available for disbursement was $15,818,156, of which $9,741,474 was disbursed on account of appropriations, leaving an undisbursed income on December 31, 1926, of $6,076,682. Against this were unpaid appropriations of $4,200,284, leaving a balance of $1,876,398 available for 1927 appropriations. The income for 1926 was $9,075,022, which, with undisbursed income on hand January 1, 1926, and refunds during 1925 on prior year appropriations of $6,743,134, brought the total amount available for disbursement to the above figure. Disbursements under the general budget in 1926 included $2,516,758 for the International Health Board, $1,412 109 for the China Medical oBard, $674,294 for the Division of Medical Education, $759,162 for the Division of Studies, and $152,737 for the Central Administration, while capital expenditures were $1,567,688 for the International Health Board, $61,164 for the China Medical Board, and $2,597,652 for the Division of Medical Education. The total assets of the foundation on December 31, 1926, were $180,397,799, including undisbursed income of $6,076,682. The book value of the principal fund was $165,204,624, to which $77,000 was transferred in 1926 from the special fund. Land, buildings and equipment at the end of 1926 were valued at $9,039,493, of which $8,991,753 were abroad and $47,740 in New York offices.

UNIVERSITY AND EDUCATIONAL NOTES

NEW YORK UNIVERSITY receives $500,000 under the will of Miss Emily O. Butler, of Scarsdale, N. Y. Most of Miss Butler's estate, which is valued in excess of $1,000,000, has been left for public uses, among other important legacies being one of $150,000 to the Union Theological Seminary. The will provides that any property remaining after all the bequests are paid shall be divided equally between New York University and Union Theological Seminary.

PRINCETON UNIVERSITY is the remainder legatee under the will of Dr. Clarence A. McWilliams, well-known surgeon, who left an estate of $105,178. The estate is left in trust to Dr. McWilliams's sisters during their life time.

DR. ROBERT LANGLEY PORTER, former San Francisco city physician, who has spent the past two years in study at Rome, has been appointed dean of the Medical School of the University of California in San Francisco. He will relieve Dr. Lionel S. Schmitt, acting dean, who has been serving at that post for five or six years.

DR. F. L. RANSOME, formerly geologist of the U. S. Geological Survey, has resigned from the faculty of the University of Arizona and has accepted the professorship of economic geology at the California Institute of Technology, Pasadena. W. P. Woodring, of the survey, has been appointed professor of invertebrate paleontology.

DR. LAURENCE IRVING, of Stanford University, has been appointed associate professor of physiology in the University of Toronto.

DR. J. H. MUIRHEAD, professor of philosophy at the University of Birmingham, England, and Bedford College, London, will serve as visiting professor of philosophy at the University of Southern California in the second semester.

DR. D. L. MACKINNON has been appointed as from August 1 to the chair of zoology in the University of London, tenable at King's College.

DR. JULIUS RUSKA, professor of the history of science at the University of Heidelberg, has been appointed director of the recently established Institute for the History of Science at Berlin.

DISCUSSION

A NEGLECTED NOTE BY A NEGLECTED MAN

IN the course of a study being made on some of the chemical and physical properties of hydrofluoric acid,[1] a somewhat extensive review of the literature was instituted. It was of interest during this work to consider the historic development of this acid from the time of its discovery.

This search has been rewarded by the uncovering of a note that to my knowledge has not hitherto been recorded. None of the treatises on historical chemistry or mineralogy, nor any of the extant bibliographies of the literature on this acid that I have had the opportunity of perusing has made any mention of this reference.

The note referred to appears as a short (eleven pages) appended section to the second edition of Dr. John Hill's treatise "Theophrastus's History of Stones. With an English Version and Notes, etc." London, 1774.[2] This note (pages 267 to 278 incl.) is, no doubt, based on a communication, or a series of communications, between the author and Karl Wilhelm Scheele, who announced his discovery of hydrofluoric acid in 1771 (Vetensk. Acad. Handl. 1771).

This note is entitled "Observations on the new Swedish acid and of the stone from which it is obtained." This note is of much interest in that it so completely and accurately describes the production and properties of hydrofluoric acid and the mineralogical and chemical properties of fluorite.

The "observations" are divided into two sections, the first dealing "Of the mineral acid in general" and the second "On the stone from which the Swedish acid is obtained." Many interesting and remarkably accurate observations are included in these few pages. It may be of interest to give the details of the experiment:

> The Process by which I tried the Substance was this:
>
> Two Pounds of the green Kind of the Stone were powdered, and put into a Glass Retort;
>
> Two Pounds of Oil of Vitriol were added to this;
>
> And a Quart of Spirit of Wine was put into the Receiver.
>
> No Heat, nor Ebullition whatsoever, followed the Mixture for some Time; and in the End but little.
>
> The Vessels were closed; and kept in a Reverberatory Furnace for fourteen Hours.
>
> The Fire was slow at first; else the Matter would have risen over.
>
> No phosphorescent Light was visible at any Time.
>
> The Fumes were some Times visible, in the Receiver; at others not. Whereas in the marine Acid they are never visible; unless Air be admitted.
>
> They were elastic; and had a Smell like those from Spirit of Salt.
>
> The Surface waved, and rose a little; and there was on it an icy, and gelatinous Substance.
>
> The upper Part of the Receiver became covered with a thin stony Crust.
>
> The *Swedes* speak of a Crust of absolute Flint, upon the Surface of the Liquor in the Receiver. But they put Water there: This was the same Substance; And it remained fix'd on Part of the Receiver: While Part was displaced; probably by some light Vapour from the Spirit of Wine.
>
> The Corrosion of the Glass of the Retort seems to be an Effect of that peculiar Sublimation which rises in the Distillation; nay, and begins to rise, even without the Operation; For watching attentively the Effect of mixing the vitriolic Acid with the Stome, I perceived, that tho' they seemed to meet without any Effervescence, yet by Degrees there appeared a slight Commotion; which increased for a considerable Time, and, during which, this

[1] Berliner and Hann, SCIENCE *61*: 498 (1925).

[2] Printed for the author, in St. James's-Street and sold by L. Davis, in Holborn; Norse, in the Strand; White, in Fleet-Street; Cater, in Holborn; Bell, in the Strand; Fletcher, at Oxford; Woodyear, at Cambridge; and Bell, at Edinburgh. 385 pp., 8°.

This also appeared in a separate reprint the same year; the only alteration being the renumbering of the pages. 16 pp., 8° (pages 1 to 5 are the title and cover pages). This is also printed for the author and sold by B. White in Fleet-Street; and J. Robson, in Bond-Street.

My attention was called to this reprint, of which there is a copy in the Surgeon-General's Library at Washington, D. C., by Dr. L. L. Woodruff.

strange Sublimation of the Flores began to be made; and increased with it; even before any Fire was used. . . . . After seven Hours a Hole was eaten thro' the Retort, and Fumes issued: But this was closed by a Crust formed of the matter within; and so well stopped, that no Vapour escaped. . . .

The final appearance of the retort and nature and properties of the products of the reaction are described. It is of interest that nowhere in this note is the term "hydrofluoric acid" employed; the mineral is on one occasion termed "fluor." Another omission for which no explanation is attempted, is the neglect of mentioning Scheele, his work, or the previously published observation. Throughout the text the only allusion made as to the original work is the term "the Swedish acid or stone." In this note Hill discusses the rôle of this acid as a "mineralizer" in ore deposits. This is also an uncredited observation and was "rediscovered" many years later. Many other novel and seemingly precocious notations are recorded.

The remarkable accuracy and extensiveness of these observations are to be marvelled at when one considers the many fields of learning in which Dr. Hill ably distinguished himself. Surprisingly little has been written concerning his life or accomplishments. Recently Dr. L. L. Woodruff, of Yale University, has published an excellent summary of this interesting man's career[3] for whom "One has but to turn the pages of London's print from 1750 to 1775 to meet his name." This short treatise gives a very clear, fair and intensely interesting outline of perhaps the most brilliant and least known character appearing in the history of science.

Dr. Hill wrote extensively on many subjects, completing an almost unbelievable number of treatises during his life. It has been said that "This gentleman may very justly be estimated as a phenomenon in literary history—he was perhaps one of the most voluminous writers that this or any other age has produced."

The diversity of his interests is indicated by the comprehensive number of subjects to which he made distinct contributions. His writings concern medicine, botany, zoology, astronomy, theology, philosophy, gardening, microscopy, pharmacology, animal husbandry, etiquette, mineralogy, naval and other histories, and in spite of all these studies he found time to edit *The British Magazine,* write a series of daily essays for a number of years, as well as publish several stories and plays. He was embroiled in innumerable polemics and wrote several satirical articles, one of the most interesting being "A Review of the Works of the Royal Society of London; containing animadversions on such papers as deserved particular observation," London, 1751, in which he ridicules some eighty original contributions to the society. This and several other articles of a similar nature made many his enemy, and yet one said, as Dr. Woodruff notes, "he was of all men I ever knew so mixed a character, none but himself can be his parallel."

J. F. T. BERLINER
WASHINGTON, D. C.

[3] *The American Naturalist,* Vol. LX, 417–441 (1926).

ORGANIC FERTILIZERS AND COTTON WILT CONTROL

IN a recent note (SCIENCE, n. s., Vol. 65, No. 1695, p. 616–617) H. R. Rosen refers to his experiments which indicate that no toxic effects are produced by *Fusarium vasinfectum* on cotton plants when organic nitrogen is used in the culture medium, and he suggests the possibility of field control of cotton wilt by the use of organic fertilizers. He states: "Orton's findings (U. S. Dept. Agr. *Farmers' Bul.* 333, 1910), which have doubtless acted as a deterrent in the use of organic fertilizers for the control of wilt, are based on very little experimental data, and his results are contradicted by the work of Fulton (La. Agr. Exp. Sta. Bul. 96, 1907). The writer has some data which seem to confirm Fulton's work."

The following quotations from the above-cited publication of W. A. Orton relate to the use of stable manure and other organic material in the practical control of cotton wilt where nematode root-knot is usually a complicating factor: "The application of stable manure has been recommended as a remedy for wilt. Our experience has been that in slightly infected fields this does give some relief, but that the wilt takes the field in the end in spite of the heaviest manuring. The use of stable manure in growing resistant varieties of cotton has been very profitable however." Under the caption "Combined treatment of wilt and root-knot" he enumerates the following among the essential principles to be observed in arranging a rotation of crops: "(1) To use crops immune to root-knot in order to starve out this pest. (2) To build up the fertility of the soil, and especially to increase the amount of organic matter or humus." Definite rotations of soil-improving crops are then suggested in detail.

My recommendation of stable manure for cotton wilt control was based on two seasons' tests at Baton Rouge, Louisiana, on land very heavily infested with *Fusarium vasinfectum* and lightly infested with root-knot nematodes. It was not put forward as a sole preventive, but was to be used in connection with other control measures, such as the use of wilt-resistant cotton varieties and a crop rotation to reduce infestation.

Rosen himself thinks that "if nematodes are present, then the use of organic matter in such soil will not remove the possibility of wilt development, although it may partially alleviate the losses that might be incurred by stimulating the growth of the plant."

It is thus apparent that there is fundamentally very little difference in the three views in so far as they relate to the practical use of organic fertilizers in cotton wilt control under usual field conditions. Rosen's present important work will doubtless stimulate further detailed investigation of the effectiveness of organic matter in the control of cotton wilt in the field, and it is hoped will lead to more extensive practical use of such material by cotton farmers, as has always been recommended as good practice by the pathologists of the U. S. Bureau of Plant Industry.

In this general connection reference may be made to the recent work by C. J. King and H. F. Loomis, of the U. S. Bureau of Plant Industry, on the control of cotton root-rot caused by *Phymatotrichum* (*Ozonium*) *omnivorum* (*Jour. Agric. Res.*, 32: 297–310, 1926), which is summarized in part as follows: "Experiments conducted in the Salt River Valley and at Sacaton, Arizona, to test the effects of manure and other organic materials on the control of root-rot have consistently shown a reduction in the infected area and the number of cotton plants dying from the disease following the treatment."

H. R. FULTON

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PLASMA CALCIUM

ACCORDING to the observations of Dr. J. B. Collip as reported in *The Journal of Biological Chemistry*, Volume LXIV, June, 1925, the thyroparathyroidectomized dog is no more responsive to the plasma calcium-raising principle contained in a hydrochloric acid extract of bovine external parathyroid glands than the normal dog.

Several tests on the effect of such an extract, prepared according to the method of the writer, have convinced us that the thyroparathyroidectomized albino rat is much more responsive to the calcium-raising principle than the normal albino rat.

The parathyroid preparation used in these tests was one which had previously been standardized by testing its reaction on normal dogs. Fifteen milligrams of the preparation in 0.85 per cent. sodium chloride solution produced an increase in the plasma calcium of a 12 to 13 kilogram dog, 3 to 4 milligrams, 15 to 17 hours following subcutaneous administration.

The potency of this preparation is further illustrated by citation to an experiment in which 60 milligrams was administered, in four doses of 15 milligrams each, to a 13.6 kilogram dog, during the course of 48 hours. During that time six plasma calcium determinations were made. The initial calcium value was 11.85 and the terminal value at which death occurred was 26 milligrams per 100 cc. of plasma.

When 15 milligrams of this preparation was administered to several normal albino rats, no noticeable increase above the normal value was found after seventeen hours. Thirty milligrams administered in two equal doses seventeen hours apart were necessary to produce an increase of approximately 5 milligrams in the plasma calcium of a normal rat.

Nine milligrams of the preparation was found to double the plasma calcium of a thyroparathyroidectomized rat of approximately the same weight, while 15 milligrams gave a value of 17.5 milligrams per 100 cc. of plasma.

We also found that as in the dog the plasma calcium value of the rat begins to drop very soon after parathyroidectomy. After reaching a value between 5 and 8 milligrams per 100 cc. of plasma, the calcium value has been found the same 200 days following thyroparathyroidectomy.

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THE ANCIENT AMERICAN CIVILIZATIONS AND CALENDARS

UNDER the above title and within a period of eight months I recently made a communication, consecutively, to the British Association for the Advancement of Science in Oxford, the International Congress of Americanists in Rome, the Anthropological Society of Washington, D. C. and the Sociedad Cientifica "Antonio Alzate" in Mexico City.

In this communication I first pointed out that all the ancient American centers of civilization were situated between the tropics; that within this zone the year consists of two seasons only: the dry and the wet and a striking phenomenon occurs, namely, the passage of the sun through the zenith twice a year, at irregular intervals, according to the differences of latitude.

I next submitted irrefutable historical, documentary, archeological and pictorial proofs that the ancient astronomer-priests, inhabiting even widely separated parts of this tropical zone, observed the phenomenon by means of gnomons consisting of upright poles, stelae, pillars, altars or constructions with vertical walls, and interpreted the periodically recurring total disappearance of their shadows about noon, as

a "descent of the sun-god," whom they represented, pictorially and sculpturally, under the form of a human being descending head foremost or seated, at rest, within the solar disk; or under the form of different birds or of a jaguar. As in Mexico, when the phenomenon occurs towards the end of the dry season, it heralds the advent of rain generated by the heat of the vertical solar rays and as the growth of vegetation ensued, the ancient Mexican sages began their solar years at the moment when, marking the approach of the rainy season, the sun-god descended upon the gnomons and these cast no shadows.

At the end of my communication to the Sociedad Antonio Alzate in Mexico City I made the suggestion that the ancient observation of the annual phenomenon, which marked the beginning of the Aztec New Year and is always allowed to pass by unobserved and unmentioned by the present inhabitants of the capital, be revived as a national school festival, which would be of educational and patriotic value as it would link the present with the past generations of native Mexicans. My suggestion was received with enthusiasm by the president and members of the society and on May 18 the impressive phenomenon was observed in several schools in Mexico City, the most important celebration being held in the great courtyard of the new normal school under the auspices of its directors, Señor Aguirre and Señora Berlanga; of Señor Gallo, the director of the Astronomical Observatory, and of Señor Heliadoro del Valle, who, with other eminent professors, initiated a celebration in which over six thousand pupils took part with song and dance. The hope I also expressed that this beautiful nature festival will likewise be revived in other anciently inhabited centers within the tropical zone bids fair to be realized next year, as official representatives of Peru and Guatemala have already expressed their intention to recommend the adoption of the same school festival in their countries, and it is probable that others will follow suit.

I am at present engaged in preparing for publication a book containing the complete presentation of the results of my researches on the subject which have extended over thirty years.

ZELIA NUTTALL

CASA ALVARADO,
COYOACAN D. F.,
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QUOTATIONS

"YOUR MONEY'S WORTH"

No one group has done more to "debunk" the commercial practices of those dealing in the special merchandise of the group than has the medical profession. Furniture dealers are by no means agreed that it is in the public interest to let it be generally known that a table made of birchwood with a thin veneer of mahogany is not the "solid mahogany" of the advertisement; the gentlemen in "suits and cloaks" are far from agreeing that there is any moral defection in describing a garment of cotton and shoddy as "all-wool"; furriers still act on the principle that it is permissible to unload dyed muskrat on the public as "Hudson seal"; the manufacturers of a well-known brand of soap admit privately that the slogan "99 and 44/100% pure" is a slogan rather than a fact. But, for over twenty years, the organized medical profession has attempted to bring to a minimum misrepresentation and deceit in the exploitation of medicinal products. Physicians, then, as a class, will probably be more interested than any other one group in the book recently published under the title "Your Money's Worth," by Stuart Chase and F. J. Schlink. Neither of the authors is a physician, but both of them have been trained to clear thinking and, what is equally evident from their book, to a lucid expression of facts. Mr. Chase, for some years on the staff of the Federal Trade Commission and at present a director of the Labor Bureau, Incorporated, is by profession a certified public accountant. Mr. Schlink, a mechanical engineer-physicist and an officer of the American Engineering Standards Committee, is fortified by an experience he had of some years on the staff of the National Bureau of Standards at Washington. "Your Money's Worth" appeared originally as a series of magazine articles, under the title "Consumers in Wonderland." The book deals not so much with adulteration of products and deceptive advertising as outstanding evils of modern merchandising as with the wastefulness of selling what are practically identical articles under various brand names and with the absence of impartial information available to the public. In a few of the industrial fields, the public is protected in its purchases by standardization worked out by the industry itself, but the ground thus covered is pitiably small. Medicine, however, has reason to feel proud of the fact that it was among the first, both in point of time and of importance, in establishing agencies whereby the public, through the profession, could be protected. In speaking of this phase of the problem, discussed by Messrs. Chase and Schlink, they say:

> Far and away the leader among the technical societies from the point of view we are considering is the American Medical Association. It is as fearless as it is explicit in the exposure of quackery. Its Council on Pharmacy and

Chemistry and its Bureau of Investigation are continuously busy in the public interest. It has haled untold rascals before the bar of public opinion; broken up hundreds of shell games.

We unreservedly recommend "Your Money's Worth" as a book that is not only readable and teeming with facts, but as one that will appeal to the physician, both in his professional capacity and also as one of the great army of ultimate consumers of modern merchandise.—*The Journal of the American Medical Association.*

SCIENTIFIC APPARATUS AND LABORATORY METHODS

PRE-STAINING IN BOTANICAL MICRO-TECHNIQUE. THE ALCOHOL-XYLOL-SAFRANIN METHOD

A FEW years ago the writer had occasion to imbed some small botanical objects in which it was important to section accurately with respect to the median axis. On clearing in xylol, the material became quite transparent, as so frequently happens, making it almost impossible to see the pieces in the paraffin block, much less to orient the material correctly for cutting. In the ribbon it was again difficult to find the small sections or to ascertain if the material was at all suitable for mounting and staining. The difficulties just enumerated are familiar to all technicians, whether small or large objects are dealt with and, as a result, much valuable time is lost, materials are ruined and the finished product is often thrown into the discard. The writer had read somewhere that it was possible to stain materials in bulk to render them more conspicuous, but details were lacking. Probably it was thought to be altogether too simple a procedure to require further elucidation. Inquiries put to several technicians did not elicit much definite information. This is not surprising, since few workers seem to be aware of the many advantages of pre-staining in micro-technique.

A method of pre-staining was devised which was so generally successful with all kinds of materials and which required so little extra effort that all subsequent imbedding has been done in this way. Not only are imbedding and cutting facilitated, but permanent mounts are also possible without extra labor. The plant parts are killed and fixed in the favorite fluid, and washing, hardening and dehydrating follow in the ordinary way. The clearing is done in alcohol-xylol mixtures, a series of 5, 10, 30, 50, 75 and 100 per cent. xylol in absolute alcohol being generally employed. The stain mixture is inserted in the series in place of the 75 per cent. alcohol-xylol. It is prepared as follows: safranin is dissolved in absolute alcohol to make a saturated solution; 100 parts of the alcoholic safranin are mixed with 300 parts pure xylol. Some of the stain will precipitate out, and the mixture may be filtered, although this is not absolutely necessary. The material is run up through the lower percentages of xylol in alcohol through the 50 per cent. mixture and is then put directly into the safranin mixture, where it is left for 24 hours or longer, depending upon the size and quantity of the material to be stained. It will be seen that the material assumes a deep red color, the fluid at the same time becoming somewhat clear. If much material is to be stained, the original solution may be replaced with fresh stain mixture. There is no danger of over-staining. From the stain mixture the material is run through pure xylol. This will bring down additional safranin as a precipitate, which may be removed by an extra washing with xylol. Embedding proceeds in the regular way. This becomes an easy task, even with small objects, and the pieces are easily seen in the paraffin block. Cutting is facilitated, and in the ribbon the sections stand out clearly. The ribbon may be examined under the microscope and surplus and useless sections may be eliminated with certainty at once. Mounting is done with a minimum of albumen fixative, using no more water than is necessary to smooth out the sections. Any excess water is immediately drained off and the slides are thoroughly dried with gentle heat. Twenty-four hours are not too long a time for drying, and an incubator is best used to eliminate dust and to guard against melting the paraffin. The slides may then be finished. The paraffin is removed with xylol in the ordinary way. At this stage they may be examined under the microscope. The sections will be found to be beautifully stained, and every detail will stand out against a perfectly clear background. A second elimination of unfit material may be made at this time with great certainty, and the only precaution necessary is to keep the slide wet with xylol during the period of examination. The slides may then be finished up by applying balsam and a cover-glass; or they may be run down through the alcohol series, which removes the stain, and any other staining method pursued.

It will thus be seen that this gives a method by which permanent mounts may be made quickly and easily. It is often desirable to make such preparations for temporary class use, and workers in certain fields will find the method adapted to many uses. Mounts thus made have been kept for months without apparent deterioration, the success being apparently determined by the elimination of all sources of water. If a safranin soluble only in alcohol were

possible of attainment, mounts made in this way would probably keep indefinitely. Diaphane has not been tried as a substitute for balsam.

The advantages of the method may be summed up as follows:

(1) Substitution of the stain mixture for 75 per cent. alcohol-xylol is hardly to be considered as an extra effort.

(2) The red objects, no matter how small, are readily visible, even in the hardened paraffin block.

(3) Accuracy of cutting is facilitated.

(4) The cut sections are quite visible in the ribbon and material may be examined superficially for accuracy of cutting, stages desired, etc.

(5) Unfit material is eliminated without further waste of time, and sections of value are not inadvertently thrown away.

(6) Critical examination of material may be made in the stage of removing the paraffin.

(7) Finished mounts may be made at once, without the necessity of going through tedious processes, and especially the individual staining of slides.

(8) Slides so made are fairly permanent.

(9) Slides not intended for quick mounting may be destained and subsequently treated to any other staining technique.

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A STUDY ON THE LIFE HISTORY OF THE BROAD FISH TAPEWORM IN NORTH AMERICA

RECENTLY the committee on scientific research of the American Medical Association made a grant to the writer in support of a field study on the life history of the broad fish tapeworm, *Diphyllobothrium latum*. This species is a well-known and somewhat serious parasite of man in various regions of the Old World. It was first reported in the United States by Leidy, who studied in 1879 a specimen taken from an immigrant. Other cases which certainly were introduced have been reported from time to time and these records have increased rapidly in frequency within recent years.

The first case in the human host unquestionably infected by larvae bred in this country was reported by Nickerson in 1906 from the clinic of Dr. Parker, of Ely, Minn. The patient was a boy only two years old who had never been out of the state and had never eaten imported fish. In 1911 Nickerson published data on 65 cases from Minnesota, including another record of local infection. Other indigenous cases have been reported by Warthin from Michigan, by Becker from Chicago, by Magath and by Riley from Minnesota, and by Lyon from Indiana. In some districts this species has come to be the most abundant and important human cestode, and this abundance is of very recent origin.

The European form has been introduced into North America many times as more than one hundred cases in man were recorded up to 1922; the list has grown since then though many cases are still unpublished. In fact in certain regions such instances have become too frequent to justify publication. The ova of the parasites were disseminated by sewage systems and thus fishes in connecting rivers and lakes are infected. The history of the parasite at Lake Geneva (Switzerland) is a striking illustration of the way in which the condition is caused and also corrected. No one has as yet shown that the parasite can find here intermediate hosts and the particular small crustacea functioning as such in Europe are rare or unknown here. Moreover, since no accurate examination has been made of the adult tapeworms taken from man here, it may be that the hosts which were infected on this continent really sheltered a new, similar and yet unrecognized species and not the well-known type found in the Old World.

Closely related if not identical species have been reported from other hosts than man in this country, thus by Warthin from the gray fox in northern Michigan, and by Hall and Wigdor from the dog in Detroit. The latter authors regarded the form they described as a new species and named it *D. americanum*. I have myself seen such a tapeworm taken from a dog at Ely, Minn., by Dr. J. E. Thompson. I have also adult tapeworms of this type collected from bears in the northwestern United States and in Alaska. The adult specimens from this continent have not been studied sufficiently precisely to justify a positive statement concerning their specific identity with the Old World species.

The last larval stage, *i.e.*, the form by which the final host is infected, is known as a plerocercoid and occurs in various fish. These plerocercoid larvae are so simple in structure and so imperfectly known that as yet no one can pass upon their relation to definite adult species. I have often found such larval stages of bothriocephalid tapeworms in fish studied in various regions from the Great Lakes to Alaska. Nickerson also records finding such larvae but states distinctly that in the present state of knowledge it is impossible to determine the species to which they belong.

The rapid increase in the number of cases of human infection reported in the United States, the consequent increasing contamination of our streams with probable like increase in infection of fish, and the severe anemia incident to the parasitization of the

species in the Old World, no less than the general hygienic and biological interest associated with the problem, make it important to study the situation promptly and in such fashion as to secure exact information on the various aspects of the question.

The American parasite in man may be identical with the European species, but, if not, two very similar species are now found side by side in certain regions. At least one of them affects man and either one or both of them also occur in other hosts in these regions. On the abundance and distribution of the parasites in other hosts as well as in man depends the frequency of human cases.

The life cycle of the tapeworms in this country must be precisely determined, whether a new species is involved or not, since this life cycle need not necessarily be identical with that reported for Europe. Evidently on the exact history of its varied relations to seasons and hosts depends both the manner and facility with which man is infected, and per contra the methods by which such infection may be regulated. In this connection it is essential to consider not only the last larval host but also the earlier phases of the life cycle as well. This is especially important since the species (*Cyclops leuckarti*) which in Europe serves as the first larval host is either rare or wanting on this continent.

Nickerson first showed that the source of human infection could be traced to a definite lake and Magath later demonstrated the occurrence of infected fish and thus of necessity infected intermediate hosts in a lake in the same general region. It is important to confirm these observations and to extend them to other waters for the purpose of determining the range and frequency of the parasite as well as the number and degree of infection of the intermediate hosts. Field studies are essential in securing the facts in the case and thus in furnishing a safe basis for views as to the probable future history of the parasite and possible means for its control and ultimate eradication.

With the purpose of studying the problem on the ground a field party has been organized and will carry on work this summer in northern Minnesota where the parasite has been so frequently reported. This party is directly in charge of the writer. Dr. T. B. Magath, of Rochester, Minn., will collaborate in the investigation and have control of the clinical experiments in particular. Dr. H. E. Essex of the University of Illinois will study the early development of the parasite and carry on the experiments in the field. Helpers will be secured as needed. The U. S. Bureau of Fisheries has undertaken to cooperate by sending an apprentice fish culturist to collect fish and maintain the aquaria. The Mayo Foundation has made a substantial contribution to the enterprise by furnishing reagents, apparatus and other help.

The problem will be attacked at once from several different angles. One line of work involves securing eggs of the adult tapeworm, developing them in cultures and employing them in feeding experiments to determine the species of crustacea or other small aquatic organisms which can function as first intermediate hosts. It may also be possible to collect naturally infected crustacea. The second stage in the life history will be sought by feeding such infected crustacea to small fish. While the time may not suffice to allow of full development in such first intermediate hosts, undoubtedly the plerocercoid larvae can be obtained as they have been previously from various fish, large and small. Among such specimens some will probably be sufficiently advanced in development to use in experiments with final hosts. In any event such material when carefully preserved and studied may show characters adequate to differentiate the plerocercoids of one bothriocephaloid tapeworm from those of another species. Here again the conclusions can be tested by feeding experiments with various hosts.

The problem can hardly be completely solved in a single summer, even with the varied attack planned. But preserved specimens will afford opportunity for continuing the study in my laboratory during the winter. Efforts will also be made to secure and transport living material so that feeding experiments can be continued there.

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SPECIAL ARTICLES

THE TOXICOLOGY OF CARBON MONOXIDE

THE toxicology of carbon monoxide gas always raises the mooted question as to whether carbon monoxide is poisonous *per se* or produces all its toxic effects from interference with proper oxygenation of tissues. In all higher animals it has been the general opinion of most pharmacologists that carbon monoxide is poisonous by virtue of its combining with hemoglobin to form CO hemoglobin and thus preventing the hemoglobin from combining with oxygen. The affinity of carbon monoxide for hemoglobin has been found to be some two hundred times greater than its affinity for oxygen. Carbon monoxide gas of itself is commonly regarded as being physiologically inert. Some recent work however seems to indicate that carbon monoxide is not as innocuous *per se* as it has been supposed to be. Thus Warburg (*Biochem. Zeit.*, 177, pp. 471, 1926) has shown that car-

bon monoxide may act as a poison in the absence of hemoglobin. He observed that carbon monoxide depresses the rate of oxygen consumption by yeasts and that the amount of carbon monoxide required to produce a given effect increased with a partial pressure of oxygen. Again, Haldane in a recent note (*Nature,* March 5, 1927, page 352) extended these observations to two higher organisms, wax moths, *Galleria mellonella* and the cress plant *Lepidium sativum.* He found that the moths behaved normally in as little as 2 per cent. of oxygen at atmospheric pressure, provided this gas is diluted with nitrogen. When however the oxygen is diluted with carbon monoxide about 16 per cent. of oxygen is needed for normal behavior. With smaller amounts of oxygen carbon monoxide is poisonous. Haldane also found that cress seeds do not germinate in an atmosphere of oxygen containing a certain amount of carbon monoxide.

In connection with the above observations the author wishes to call attention to certain observations which he has made and concerning which a brief note was published already (Macht, Blackman and Swigart, *Proc. of Exp. Bio. and Med.,* 1924, Vol. 91, pp. 227). While engaged in the study of the effects of various drugs and toxins on the growth of the seedlings of *Lupinus albus* studies were made on the growth of such seedlings in weak solutions of blood and hemoglobin. The procedure briefly consisted in growing seedlings of *Lupinus albus* in upright test tubes containing equal parts of distilled water and a plant physiological solution (Shive) on the one hand, and of other seedlings of *Lupinus albus* in exactly the same control solution plus small amounts of unknown substances to be studied. The elongation of the straight and well-defined roots was measured accurately in each case. It was found that 1 per cent. solutions of blood give a growth index as compared with a growth in normal nutrient solution without blood of about 72 per cent. Having studied repeatedly the effect of normal blood and normal hemoglobin solutions on the growth of *Lupinus albus* seedlings in the dark, experiments were made on the growth of the seedlings in solutions of blood containing various amounts of carbon monoxide hemoglobin. Here a new and unexpected observation was made. It was found the solution of carbon monoxide hemoglobin produced a poisonous effect on the seedlings as shown by an inhibition of their growth. The following four protocols will serve as illustrations.

EXPERIMENT NOVEMBER 3, 1925

Defibrated blood of a pig was saturated with pure carbon monoxide obtained by the addition of concentrated sulphuric acid to formic acid. A 1 per cent. solution of the normal pig's blood was made in Shive solution as described above; another 1 per cent. solution was made of the blood which was saturated with carbon monoxide. A third solution was made containing 0.5 per cent. of the monoxide blood. Ten seedlings each of *Lupinus albus* were carefully measured and immersed in each of the above solutions and all of the plants were left in the dark at a temperature of 22° C. After eighteen hours it was found that the growth of the seedlings in normal blood gave an index of 75 per cent. Growth in 1 per cent. carbon monoxide blood gave an index of 37 per cent. Growth in 0.5 per cent. of carbon monoxide blood gave an index of 48 per cent.

EXPERIMENT OCTOBER 9, 1925

Specimen of blood was obtained from a normal rabbit and a 1 per cent. solution was made. The rabbit was then allowed to inhale pure carbon monoxide until first signs of intoxication appeared. Blood was then drawn and it was found to contain about 30 per cent. of carbon monoxide hemoglobin. The growth of seedlings in a normal blood solution, and the blood obtained after inhaling carbon monoxide gave the following figures: Growth in normal blood 1 per cent. gave index of 72 per cent. Growth in carbon monoxide blood 1 per cent. gave index of 60 per cent.

EXPERIMENT MARCH 31, 1927

A rat was killed with carbon monoxide gas. The relative indices of growth in 1 per cent. of normal rat blood and 1 per cent. of blood from the poisoned animal were as follows: Normal 75 per cent., carbon monoxide blood 47 per cent.

EXPERIMENT APRIL 6, 1927

Pigeon was allowed to inhale carbon monoxide until convulsions occurred. Growth in solution of 1 per cent. of its blood was compared with growth in a 1 per cent. solution of normal pigeon's blood. The following results were obtained: Growth in normal blood 70 per cent., growth in carbon monoxide blood 50 per cent.

Similar experiments were performed with bloods of men and several other animals. In each case it was found that the growth of *Lupinus albus* seedlings was markedly inhibited by solutions of carbon monoxide blood and also solutions of pure carbon monoxide hemoglobin. It was found that in cases of very sensitive preparations a definite inhibition in growth of seedlings could be noted in solutions of monoxide blood diluted to 0.01 per cent. when the preparations were kept in the *dark* and at a temperature of 20° C. The above observations speak in favor of poisonous effects produced by carbon monoxide or rather carbon monoxide hemoglobin apart from an interference with oxygenation processes.

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ON THE THICKNESS OF THE HELMHOLTZ DOUBLE LAYER

HELMHOLTZ and Lamb assumed the double electric layer around colloid particles to be of molecular dimensions, but Gouy calculated it to be greater and to increase with dilution of the solution. Whereas the diameter of a water molecule is about 0.03×10^{-6} cm, Gouy calculated the distance (a) between the surface of a colloid particle (having 10 electrostatic units of charge per sq. cm of surface) and the center of gravity of the excess ions of opposite sign in a 0.1 N solution of monovalent salt at 18° to be 0.096×10^{-6} cm, and in a 0.001 N solution 0.96×10^{-6} cm. Gouy assumed a dielectric constant of 80. Burton showed that Gouy's a was equal to Debye's $\frac{1}{K}$. Burton and Currie showed experimentally that the Helmholtz double layer was thick enough to account for repulsion between colloid particles as well as larger bodies (shot) and that its thickness increases with dilution. They account for the discharge of colloid particles on the addition of salts by the thinning of the double layer to the point of break-down of the dielectric.

In previous papers (McClendon-1926) it has been shown that the double layer acts as a condenser and becomes thicker the greater the dilution of the solution. It was hoped that a method might be found to measure its thickness.

Since the surface of a charged metal electrode (immersed in an electrolyte solution) and the layer of excess ions of opposite sign act as the plates of a condenser whose capacity may be measured, knowing the dielectric constant, the thickness of the Helmholtz double layer may be calculated. The capacity in microfarads, $C = 0.0885 \times 10^{-6} \frac{KS}{T}$, where S is the surface area of the electrode in cm², T is the thickness of the dielectric (Helmholtz double layer) and K the dielectric constant. The conductivity vessel contained two bright gold electrodes each of 10 cm² surface (5 cm² face and 5 cm² back) and acted as two condensers in series, equivalent to one condenser with double the thickness of dielectric. Assuming $K = 80$ the equation becomes

$$T = \frac{7.08}{C} \times 10^{-6} \text{ cm}$$

and the thickness of the Helmholtz layer will be $\frac{T}{2}$.

The capacity is most easily measured using alternating current, but since it changes slightly with frequency the electrostatic value can only be approximated.

As will be seen from the table the thickness of the Helmholtz layer as measured is for 0.1 N solution 0.194×10^{-6} cm whereas Gouy calculated 0.096×10^{-6} cm, a fairly close agreement particularly in view of the uncertainty of the dielectric constant. The measured value for 0.001 N solution, 0.325×10^{-6} cm, is far from Gouy's value of 0.96×10^{-6} cm, but the change is in the right direction, *i.e.*, increase in thickness of the Helmholtz layer with dilution of the electrolyte.

Frequency in cycles per second	Normality KCl	Capacity microfarads	$\frac{T}{2}$ Unit 10^{-6} cm	Normality KCl	Capacity microfarads	Unit 10^{-6} cm $\frac{T}{2}$
436	0.0002	11.3	0.313	.....	.....	.....
640	"	10.7	.....	.....	.....	.....
885	"	10.2	.....	0.001	11.0	.....
1000	"	9.7	0.365	"	10.9	0.325
1375	"	9.5	.....	"	10.5	.....
1720	"	.....	.....	"	10.3	.....
1950	"	8.4	.....	"	9.8	.....
2820	"	6.7	.....	"	9.2	.....
4420	"	4.2	0.843	"	7.3	.....
1000	0.002	15.3	0.231	0.01	14.2	0.249
1000	"	.....	.....	0.1	18.3	0.194

The fact that the thickness of the Helmholtz layer increases with frequency of the alternating current might be explained by lack of time for the ions to migrate to their definitive positions.[1]

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